

ABSTRACT

A multi-channel optical frequency mixer for all-optical signal processing and a method for engineering the same. The multi-channel mixer uses a nonlinear optical material exhibiting an effective nonlinearity d_{eff} whose spatial distribution is defined by a quasi-phase-matching grating, e.g., a QPM grating. The spatial distribution is defined such that its Fourier transform to the spatial frequency domain defines at least two wavelength channels which are quasi-phase-matched for performing optical frequency mixing. The wavelength channels correspond to dominant Fourier components and the Fourier transform is appropriately adjusted using grating parameters such as grating periods, phase reversal sequences and duty cycles to include an odd or even number of dominant Fourier components. The multi-channel mixer can perform frequency mixing operations such as second harmonic generation (SHG), difference frequency generation (DFG), sum frequency generation (SFG), and parametric amplification.